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FOREST INSECT INVESTIGATIONS

REPORT

ON

RELATION OF INCREMENT GROWTH TO ATTACK

BY

D. PONDEROSAE IN GROUP-KILLINGS OF VARIOUS SIZES

By
M.W. Blackman
Specialist in Scolytidae
U.S. Bureau of Entomology
November 5, 1926

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Ponderosa Pine?
Grand Canyon?

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RELATION OF INCREMENT GROWTH TO ATTACK BY D. PONDEROSAE IN GROUP-KILLINGS OF VARIOUS SIZES

Early in the summer of 1926 it became apparent that in small centers of attack the beetles usually showed a selection of the weaker, slower growing trees while in larger groups no such selection was evident. During early August 500 increment cores were taken in the North end of the Forest in the area between Joes Mud Hole and Jacob's Lake. Of these 500 cores 491 were used in compiling the following data, the others being discarded on account of some omission in field data.

Cores were taken not only of trees killed in 1925, but of trees attacked 1925 the attack failing, trees in the same group killed 1924, and of green unattacked trees in the same groups. A few trees attacked in 1926 were also studied. The green trees studied were selected as similar in D.B.H., heighth and crown character to the killed trees as possible, and whenever possible cores were taken from several green trees for comparison with each one killed in 1925. The data is summarized on the following pages.

In groups of all sizes the data is summarized as follows, the figures representing the number of rings in the last half nich radius.

Average Increment of all trees (491)	18.57
" " " " " green trees (220)	17.53
" " " " " trees killed 1925 (188)	20.16
" " " " " " failed 1925 (51)	17.45
" " " " " " killed 1924 (26)	19.31
" " " " " trees attacked in 1926 (4)	26.50

This would indicate that the average of the trees killed in 1924 and 1925 in these groups were growing more slowly than the average for the groups and much more slowly than the survivors. The average growth of the trees on which the attack failed in 1925 was especially rapid, even slightly more rapid than in the unattacked green trees. The averages for the trees killed in 1924 are based on too few trees to be really reliable. This is also true of the trees attacked in 1926 in which class only 4 trees were found adjacent to old groups and these were not filled in. All four of the trees attacked in 1926 occurred in one group which also contained trees killed in 1925 and 1924. The data on this group is rather interesting and worthy of consideration by itself. The trees were rather short scrubby ones most of them attacked by mistletoe. They occurred in poor rocky soil near the top of a south slope. In spite, however, of their apparent unhealthy condition they were making a fair increment growth but the axial growth was not so good.

Av. Increment of all trees (21)	20.84
" " " Green trees (6)	16.50
" " " Trees killed 1924 (5)	18.00
" " " " " 1925 (6)	23.83
" " " " attacked 1926 (4)	26.50

The data is confessedly insufficient but those increments of 1926 attack were all we were able to get. The data, however, seems consistent with other collected. - the green trees showing the most rapid growth, the 1924 attack on trees of slightly better than average growth and those of 1925 and 1926 on progressively slower growing trees.

The summaries of the data on groups of different sizes is given in the following pages.

Group of 1 Tree Killed

Av. Increment of all trees (50)	20.90
" " " Green Trees (30)	18.68
" " " Trees killed 1925 (18)	25.66
" " " " " 1924 (2)	18.00

Growth of 1925 killed trees 26.8% slower than of Green Trees.

Group of 2 Trees Killed

Av. Increment of all trees (65)	18.37
" " " Green " (29)	15.69
" " " Trees Killed 1925 (23)	20.04
" " " " failed 1925 (16)	18.89
" " " " Killed 1924 (4)	27.25

Growth of 1925 trees 21.7% slower than of green trees.

Groups of 3 Trees Killed

Av. Increment of all Trees (35)	17.31
" " " green trees (16)	14.31
" " " trees killed 1925 (12)	21.25
" " " " failed 1925 (4)	19.00
" " " " killed 1924 (3)	15.33

Growth of 1925 Trees 27.95% slower than of Green Trees.

In summarizing the data for other division of this report I have arbitrarily used the number of trees in group killings as a criterion of the degree of epidemicity and in those connections have assumed that groups of three or fewer killed trees were endemic. If we average the data from this s study of increment cores on this basis we find groups of 1 to 3 trees showing the following relation between killed and green trees.

Groups of 1-3 trees killed.

Average increment of all trees (150)	18.97
" " " Green Trees (75)	16.44
" " " Trees Killed 1925 (53)	22.19
" " " " failed 1925 (13)	18.92
" " " " killed 1924 (9)	21.22

Growth of 1925 killed trees 25.91% slower than in green trees.

As the number of trees in a group increases above three there is less and less difference in the rate of growth of the trees killed in 1925 and those still green, until in groups of more than 6 trees the trees killed in 1925 are likely to be more rapid in growth than those still unattacked. This is brought out in the following tabulations:

Groups of More Than 4 Trees Killed.

Av. Increment of all Trees (341)	18.11
" " " green Trees (145)	18.00
" " " Trees Killed 1925 (135)	19.37
" " " Trees failed 1925 (44)	17.02
" " " " killed 1924 (17)	18.3

Growth of 1925 killed Trees 7.61% slower than in Green Trees

Groups of 4 Trees Killed.

Average Increment of All Trees (101)	18.00
" " " Green Trees (42)	16.16
" " " Trees Killed 1925 (39)	19.74
" " " Trees failed 1925 (13)	17.46
" " " " Killed 1924 (7)	17.43

Growth of 1925 killed Trees 18.64% slower than in green Trees.

Groups of 5 Trees Killed.

Av. Increment of all trees (63)	18.25
" " " green " (22)	16.86
" " " Trees Killed 1925 (30)	18.93
" " " " failed " (6)	18.66
" " " " killed 1924 (5)	19.80

Growth of 1925 Killed Trees 10.88% slower than in green trees.

Groups of 6 Trees Killed.

Av. Increment of all Trees (29)	21.55
" " " green Trees (10)	22.20
" " " Trees Killed 1925 (12)	23.83
" " " " failed 1925 (2)	27.00
" " " " killed 1924 (5)	18.00

Growth in 1925 killed trees 6.84% slower than in Green Trees.

Groups of 7 Trees Killed.

Av. Increment of all Trees (59)	18.05
" " " green " (34)	19.28
" " " Trees Killed 1925 (21)	16.71
" " " " failed 1925 (4)	14.75

Growth of 1925 killed Trees 13.33% more rapid than in Green Trees

Groups of 9 Trees Killed.

Av. Increment of all Trees (11)	12.36
" " " Green " (3)	10.66
" " " Trees Killed 1925 (4)	11.75
" " " " failed 1925 (4)	11.75

Growth of 1925-Killed Trees 9.27% slower than in Green Trees.
(The number of cores summarized for the above group is too small to give reliable results).

Groups of 10 - Trees Killed.

Av. Increment of all Trees (32)	15.34
" " " Green Trees (20)	15.95
" " " Trees Killed 1925 (7)	15.29
" " " " failed 1925 (5)	13.00

Growth in 1925 - Killed Trees 4.13% more rapid than in Green Trees.

Groups of 15-32 Trees Killed.

Average increment of all Trees (46)	21.76
" " " Green Trees (14)	23.71
" " " Trees Killed 1925 (22)	22.00
" " " " failed 1925 (10)	18.50

Growth of 1925-Killed Trees 7.21% more rapid than in Green Trees.

It would seem clear from the above data that in groups killings of 3 trees or less the increment growth of the trees killed in 1925 is less than 75% as much as that of green trees in the same groups showing the same qualities as to site, diameter and crown character. Also in all groups of 6 trees or less the killed trees show slower growth than the adjacent green trees of like characteristics. While in groups of more than 6-trees-killed the 1925 trees show more rapid growth than the green trees remaining. This latter difference, however, is rather small and variable and perhaps the true conditions might better be expressed by saying that in the larger groups the beetles show no decided discrimination in their choice of trees but show a slight tendency to attack trees of average or slightly above, average vigor. This is in accord with Keen's findings in 1925.

It would also seem that the above data furnishes us with a more scientific criterion of epidemicity of the Black Hills Beetle than we have had in the past. We might say with some justice that where group killings of six or fewer trees occur the infestation is endemic and that larger groups indicate a true epidemic condition. However, this test would have to be applied with considerable judgement and certainly could not be followed blindly. For instance, if after a period of low endemic infestation when the groups for years had consisted of one or two trees, a year should come when groups of 3, 4 or 5 were common, it would indicate a very serious condition which would be likely in another two or three years to blossom out into a really serious epidemic. On the other hand if, as in 1925, groups of from 25 to 100 or more should suddenly be reduced to groups of 10 to 20 the beetle would still be epidemic theoretically, but the condition would be much less alarming than in the first instance. Thus in my own opinion any survey should be checked by a careful examination and count of the brood in the infested trees. If the average brood per square foot (on examination in mid July). is found to be

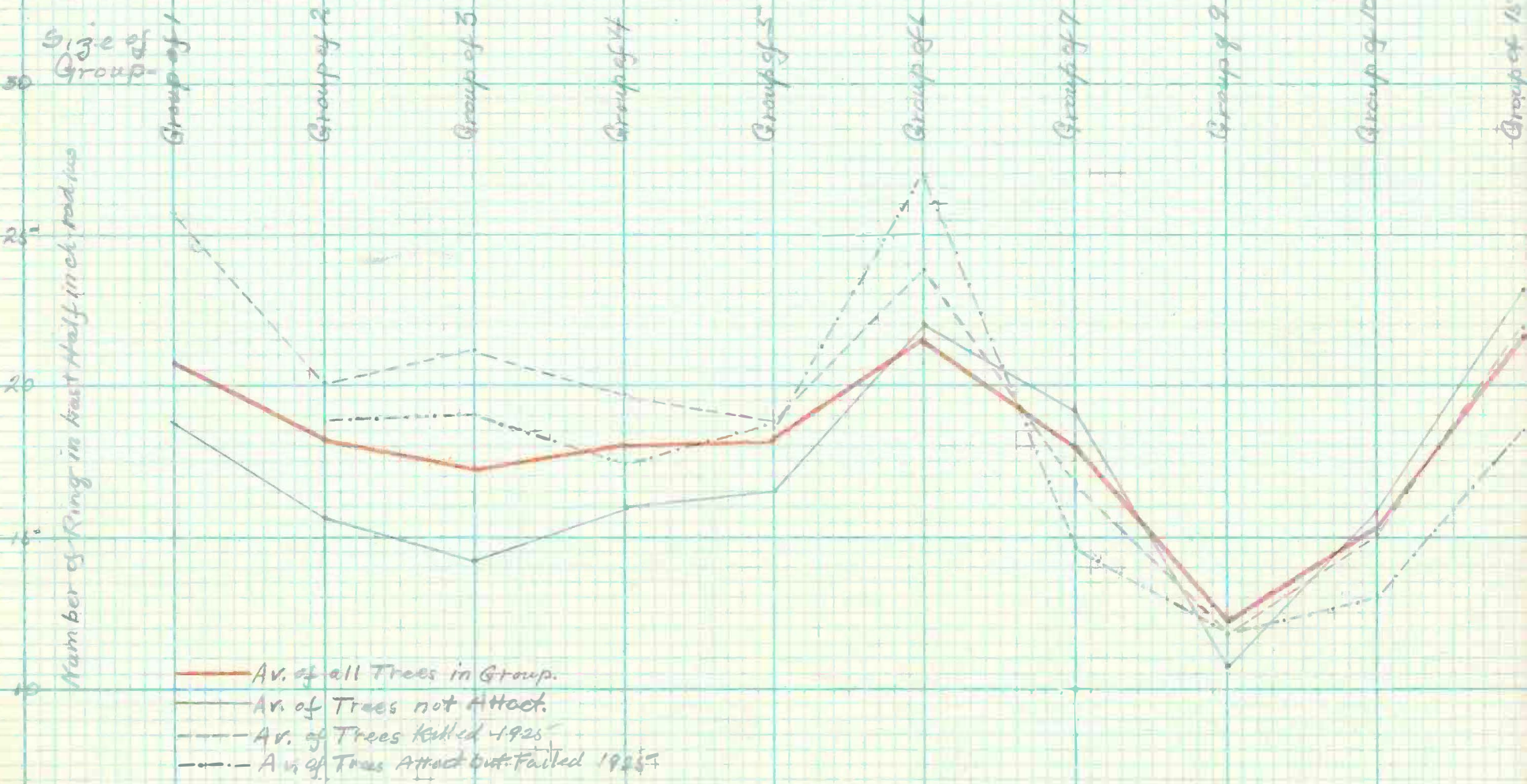
brood per

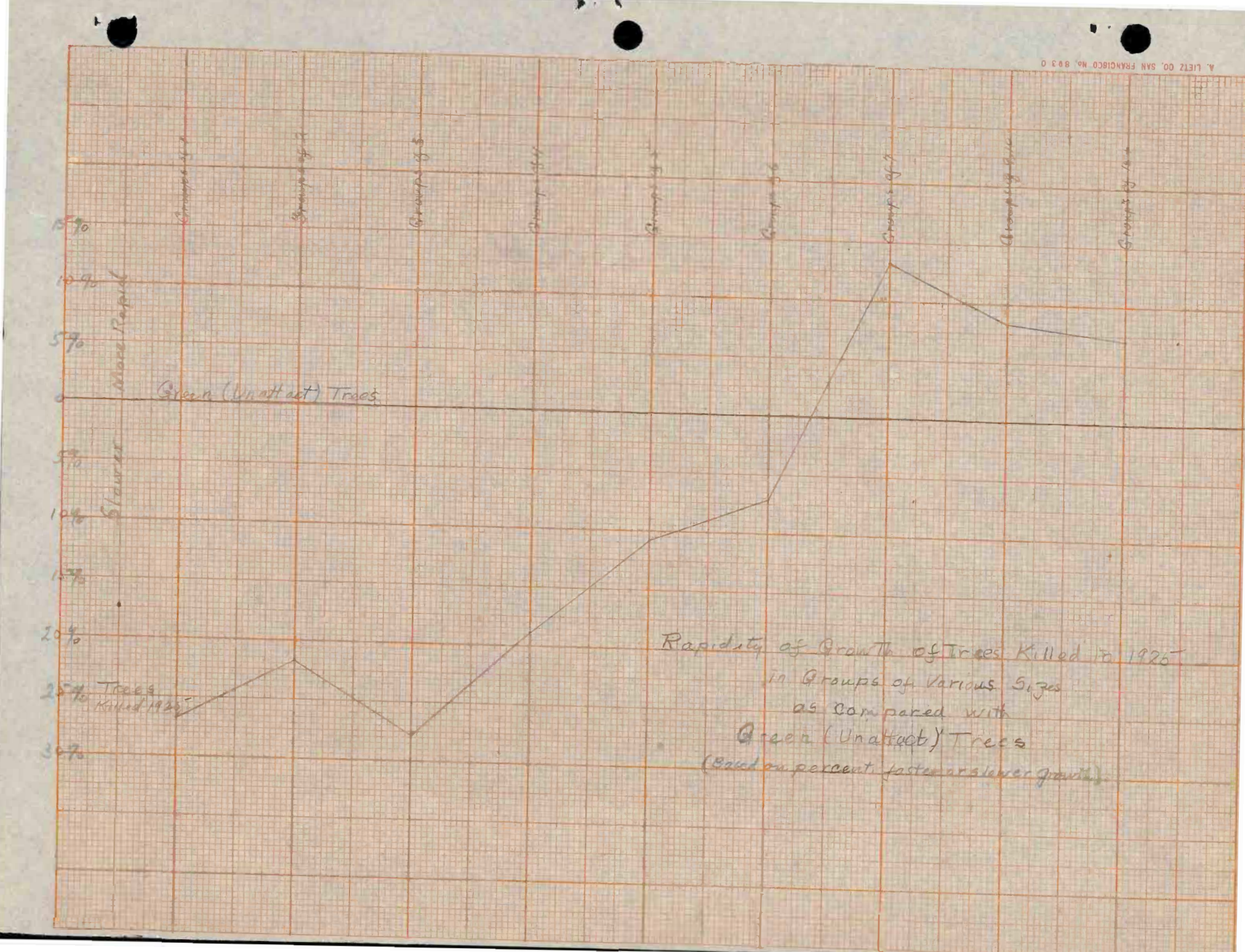
three or four times as numerous as the beetles attacking, that is an indication that the infestation is likely to increase the following year. If on the other hand the brood per square foot is less than twice the attacking beetles it is a good indication that the infestation is on the decline.

The accompanying graphs are intended to show the relation of radial increment to attack in group killings of various sizes. The first graph is based on the data exactly as given in the preceeding pages. It will be seen that in groups of 9 trees killed the graph does not follow the general tendency shown in other groups. This is due to insufficient data for groups of that size and a truer idea would have been conveyed by combining groups of 9 and 10 trees killed as was done in the second graph.

The ~~record~~ second graph is intended to compare the rapidity of growth of green trees and trees killed in 1925 in the same groups of various sizes. In working this up the growth of green trees is used as the basis of comparison in all groups and is represented in the graph by a straight line and the percent. faster or slower growth of the trees killed in 1925 is used in constructing the graph. It will be readily seen that in groups of 6 or less the growth of the killed trees is slower, while in larger groups it is more rapid.

Increment Growth in Relation to Attack by D. ponderosae in Group Killings of Various Sizes.




Groups of 2 Trees
Groups of 3 Trees
Groups of 4 Trees
Groups of 5 Trees
Groups of 6 Trees
Groups of 7 Trees
Groups of 8 Trees
Groups of 9 Trees
Groups of 10 Trees
15%
10%
5%
0
5%
10%
15%
20%
25%
30%
Slower More Rapid
Green (Unattact) Trees
Trees Killed 1926
Rapidity of Growth of Trees Killed in 1926
in Groups of Various Sizes
as Compared with
Green (Unattact) Trees
(Based on percent faster or slower growth).